

# ITS Deployment around the World: Lessons Learned

*The lessons learned from deploying intelligent transportation systems (ITS) especially in the areas of traffic management, traveler information, and transit systems, have been collected from an international brainstorming session involving experts from 13 countries. The lessons, as outlined by the authors, are intended particularly to help developing countries get their ITS programs underway. The plan is to continue the brainstorming activity through electronic mail. Readers of this article around the world are invited to join the brainstorming project and share their perceived problems as well as initial ITS experience.*

**Christine Johnson and Kan Chen**

Transportation has been — and will continue to be in the foreseeable future — a driving force behind economic development in all countries. We live at a time when about half of the countries, and two thirds of the world population, are on the brink of transition to modern economies. A linchpin, or critical factor, in that transition is transportation. As living standards increase, there is even a more rapid growth of demand for transportation capital, for highways and railways, for cars and trucks, in the developing countries. And, often therein lies the problem — the capital required to make such a transformation in these numerous countries probably exceeds the combined resources from all existing sources that can be expected to be devoted to transportation on any kind of reasonable basis.

Ironically, the developed world is arguably facing some similar difficulties — where many countries have reached the limit of their physical and environmental capacity for construction of new transportation facilities. It is often said that we can no longer build

our way out of congestion. In the face of this limitation, many transportation professionals are turning to intelligent transportation systems (ITS) as a means of squeezing more efficiency/productivity out of a given transportation investment, whether it is the infrastructure or the vehicle fleet. There is strong evidence that ITS is delivering on its promise.

## **looking for Solutions**

Recently the developing nations and economies in transition have begun to look toward ITS for solutions to the gigantic problem of transportation development faced by these countries. The question has been raised: What lessons can be learned from ITS deployment in developed countries around the world that can be useful to ITS applications in developing countries with little ITS experience? A systematic search for answers to this question has been a program activity within the Permanent Association of Road Congresses (PIARC) ITS Committee (C16).

The PIARC, also known as the World Road

Association, has been in existence since the first International Road Congress held in Paris in 1908. The organization is still based in Paris, but now has 88 member governments, and other members that comprise 113 countries worldwide. The Association emphasizes improvement of knowledge transfer, with priority given towards developing countries and economies in transition. Besides frequent publication of documents, newsletters, and a quarterly magazine, the organization holds a World Road Congress

every four years: the next one will take place in Kuala Lumpur (Malaysia) in October, 1999.

Since its establishment in 1995, the PIARC ITS Committee (C16) has been compiling lessons learned from ITS deployment around the world through the collection of case studies. Such lessons are intended to help countries and regions which are considering, planning, or beginning to get into ITS activities, as well as to help experienced ITS implementors share experience with one another. These lessons could then be tabulated as "precautions" as one considers the launching of various ITS services, as illustrated by the matrix shown in Appendix 1.

---

*" Recently the developing nations and economies in transition have begun to look toward ITS for solutions to the gigantic problem of transportation development faced by these countries. "*

---

### Need for Brainstorming

By the end of September 1997, some 14 cases had been collected from 8 countries in Asia, Europe, and North America. While the lessons learned from each case proved to be both insightful and instructional on the basis of the rich and candid description of the suc-

cess and not-so-success stories told, it was felt that the process could be augmented by asking a number of ITS experts to make direct suggestions of lessons learned without getting into any detailed description of individual cases. This complementary process not only would be more efficient in getting to the "bottom line", but also would help the experts search in their memory and suggest valuable collective advice if they could interact through a brainstorming setting.

### Procedure

The brainstorming session began with introductory remarks and an explanation of the ground rules of brainstorming. These rules included (1) no negative comments allowed, (2) brief answers to each question be given in a round robin fashion (with encouragement to build on others' answers), and (3) priority assigned to answers at the end through a voting process.

The participants were then assigned to

three breakout groups, each convening in a separate room with a facilitator and a recorder. All three breakout groups started with the common question on how to get ITS activities started by a country or region that has no prior experience. After that, the breakout groups were asked three different sets of questions on (1) advanced traffic management systems, or ATMS, (2) advanced traveler information systems, or ATIS, and (3) advanced public transportation systems, or APTS, respectively. At the end of the breakouts, all participants were brought back together to hear summary reports from the facilitators and recorders, and closing remarks.

A synthesis of the results are given below under four headings:

## ADVICE ON HOW TO GET ITS STARTED

**Question:** What steps should be taken by a country without prior experience to get ITS started?

**Answers:** (consolidated from all three groups):

1. Develop a needs-driven master plan.  
Determine first what the major transportation problems are to be solved based on the needs of the customers. Set specific short-term and long-term goals and objectives. Identify existing projects that may not have been recognized as ITS projects. Develop a master plan or strategic plan that would build the basic supporting infrastructure and leverage on the existing projects and existing infrastructure. Search for funding and set priorities based on cost-benefit analysis for ITS deployment (e.g., ITS for urban area first) as well as for R&D. Choose the right first projects that are relatively small and have high probability of early success to show efficiency and effectiveness of ITS.

Establish today's situation as a baseline for future evaluation.

2. Involve the right people.  
Develop liaison and institutional arrangements with all potential interested parties and stakeholders. Identify each stakeholder's perceived problems, expectations, and potential roles. Search for people with the right, or at least adequate, skills. Identify and cultivate a top-level champion(s) who can get endorsement of the ITS master plan by the key decision makers.
3. Inform and educate the transportation professionals and the public.  
Educate and train, in the broadest sense, both technicians and decision makers, including the politicians, about ITS. Invest in a comprehensive study that will define the major problems to be solved and identify applicable ITS approaches. Learn from experienced ITS experts by collecting information at World Congresses, sending missions to countries with established ITS programs, and doing "joint pilot programs" with these countries. Hire knowledgeable consultants for education and on-job training. Educate the public about ITS and its benefits.

## ADVICE ON LAUNCHING ATMS SERVICES

**Question:** What are the institutional pre-conditions for initial applications of advanced traffic management systems (ATMS)?

**Answers:**

1. Establish the baseline.  
Learn from today's situation regarding the multiple agencies that will need to work more closely in the future. Understand the "network." Organize information exchange between agencies. Teach and learn through information exchange.

2. Develop new institutional arrangements. Document through memos of understanding among the involved agencies on how to work together. Define where ATMS does what, and by whom. Clearly document who has what responsibility. Beware of shared responsibilities. Establish a coordination body.
3. Prepare for operation under the new environment. Be aware of the need for qualified staff. Know the rules for procurement in the ITS world that may be different from yours.

**Question:** What are the enabling technologies for initial applications of advanced traffic management systems (ATMS)?

**Answers:**

1. Apply the principles of leveraging. Leverage from technology already built in the current system. Build on what exists in the current communications infrastructure.
2. Use the needs-driven approach. Match ATMS technology against the needs. Get a good idea about the countries' characteristics — they should affect the choice. ATMS requires reliability.
3. Use an evolutionary strategy. Start small, simple technology with an expandable version — learn from experience. Use technology complying with recognized standards to avoid single-source solutions. Use field tests to teach and train staff. Learn from others.

**Question:** What early actions could be taken for advanced traffic management systems (ATMS) applications?

**Answers:**

1. Do early deployment planning. Start with monitoring (learn). Know overall demand, what, where? Know

what you're in for, define problems, know costs.

2. Be prudent in taking early actions. Know the problem, define the solution, and only then buy. Get commitment before you start. First step is network planning. First system should work successfully (within budget and with the most effective solution); may not fail.

**Question:** What precautions could be suggested for initial ATMS deployment based on lessons learned from experience?

**Answers:**

1. Don't start before solving institutional issues.
2. Manage expectations. Don't over-promise results.
3. Practice good planning. Don't ignore existing options/systems. Be flexible enough to react immediately with alternatives when problems arise. Don't make a closed system that is not easily expandable. Don't use proprietary solutions: use open standards.

## ADVICE ON LAUNCHING ATIS SERVICES

**Question:** What are the institutional pre-conditions for initial applications of advanced traveler information systems (ATIS)?

**Answers:**

1. Establish the basic requirements. Recognize that different projects/systems/countries require different institutional arrangements. Assure availability and free flow of reliable data.
2. Develop new institutional arrangements. Harmonize affected institutions, and

understand user needs and stakeholder interests. Delineate public and private roles and responsibilities.

3. Prepare for operation under the new environment.  
Estimate the market, benefits, and implications for safety. Identify sources for seed money and continuing funding. Recognize importance of managing procurement properly.

**Question:** What are the enabling technologies for initial applications of advanced traveler information systems (ATIS)?

**Answers:**

1. Communication technologies.  
ATIS requires adequate communications capability including, depending upon application, reliable one-way and two-way landline and wireless communications and mobile receiving devices.
2. Databases.  
A basic data infrastructure including traffic flow data and geographic and/or other databases is required.
3. Terminals.  
Depending upon application, kiosks or other fixed-point access may be required. Vehicular access may require on-board sensors (including GPS receivers), processors, databases, and communications equipment.
4. Standards.  
Applicable open standards should be applied in the context of national/regional/local ITS architecture.

**Question:** What early actions could be taken for advanced traveler information systems (ATIS) applications?

**Answers:**

1. Focus on users.  
Educate the users and understand their needs.
2. Install simple technologies as a first step in an evolutionary approach.  
broadcast radio), and expand step by step. Keep early focus on effective data Start small (e.g., just one variable message sign). Use whatever is already available (e.g., infrastructure. Use modular design and open architecture.
3. Review and revise current budget approach.  
Budget for long-term system costs (e.g., 10-15% project cost for annual maintenance

**Question:** What precautions could be suggested for initial ATIS deployment based on lessons learned from experience?

**Answers:**

1. Learn early.  
Study prior experience (including failures) of others; don't reinvent.
2. Manage expectations — Don't manipulate information and don't oversell.
3. Practice good planning.  
Understand long-term implications, including costs of maintenance and updates. Proceed in small, credible steps. Apply quality control and use robust equipment with after-sales support.

## ADVICE ON LAUNCHING APTS SERVICES

**Question:** What are the institutional pre-conditions for initial applications of advanced public transportation systems (APTS)?

**Answers:**

1. Develop new institutional arrangements. Develop concrete partnerships and agreements between public authorities (including highway authorities) and transport service providers. Establish cooperation between transport service operators if there are more than one in the same region.
2. Establish basic requirements. Ensure that there is public and government support for expending resources to improve public transport. For this to happen, there must be a pre-existing market

enabling legislation to allow new technologies and new services.

**Question:** What precautions could be suggested for initial APTS deployment based on lessons learned from past experience?

**Answers:**

1. Quality of information and service. Information provided about public transport must be credible. Consider the total trip, and the provided services, not just the public transport piece. Carefully consider the reliability and quality of the equipment and devices. Don't give too

---

*" It is hoped that representatives from additional developing countries will participate in the future brainstorming so that a wider range of problems and experience will be included. "*

---

demand for the planned APTS service. Users must be willing to accept and use new services. There must be a willingness to invest in a climate of high uncertainty.

3. Prepare for operation under the new environment. Prepare to integrate fare systems, preferably with single payment options. The public transport operators should provide contractual service level guarantees. Adequate information on services must be provided. There must be adequate budgets and skills to support operations and maintenance of APTS.
4. Establish public policies. A policy framework should be in place on public transport. A policy restricting parking in certain areas should be in place. There may be a need for new

much information to users; i.e., don't overload them with information.

2. User orientation. Don't underestimate the influence of the users on the definition and determination of success. Try to show concrete benefits to the users.
3. Planning and policy. Support must be provided from the public sector to the private operator or operators (not just monetary, but with coordination, policy, etc.). Show financial benefits and be sure you can make a good business case. Ensure that the total societal benefits are included in any analysis.

**OBSERVATIONS**

The results of the brainstorming session are valuable in that they both reinforce and

go beyond the results from the 14 case studies. They are reinforcing as there are no contradiction between the two sets of results. The brainstorming results have gone beyond those of the case studies in terms of broader aspects (e.g., policies) and broader application areas (e.g., public transit). On the other hand, the case studies certainly have more depth in tracing the context as well as the reasons behind the success and failure of ITS deployment.

Due to time and space limitations, the brainstorming session did not get into as many application areas as originally planned. Consequently there were no discussions on lessons learned in such areas as commercial vehicle operations (CVO), electronic toll collection (ETC), and advanced vehicle control and safety systems (AVCSS). Plans are underway to conduct future brainstorming interactions in these other areas using electronic mail. It is hoped that representatives from additional developing countries will participate in the future brainstorming so that a wider range of problems and experi-

ence will be included. The authors would like to invite readers of this article around the world to indicate their interest by contacting us in the immediate future through the following electronic mail address:  
kanchen@slip.net

—

**Acknowledgments:** *All the international participants in the brainstorming session during the ITS World Congress in Berlin should be thanked for their contributions. Acknowledgments are due to the breakout group facilitators (John Miles of UK, Yvon Loyaerts of Belgium, and Job Klijnhout of the Netherlands) and recorders (Bob French, Mike McGurrian and Ray Starsman, all from the U.S.) who performed their volunteer tasks with excellence. Special thanks to George Beronio of the U.S. who helped with the mailing and facility arrangements for the brainstorming session. Credits are due to Michel Ray of France who suggested the basic framework of the matrix shown in Appendix 1, and to Hillie Talens of the Netherlands who helped expand the contents of the matrix.*

**Appendix 1 Launching ITS Service**

ITS Services	Institutional Pre-Conditions	Enabling Technologies	Possible ITS Actions	Precautions
<b>ATMS</b>				
a) Corridor Traffic Control	-Cross-jurisdictional cooperation	-Conventional traffic controls -Traffic sensors and communications systems	-Share traffic information and coordinate control strategies	-Emphasize benefits to all in sharing information without surrendering control
b) Incident Management	-Cross-agency cooperation	-Electronic data exchange	-Establish coordination among traffic management center, police, towing services, tire department, and emergency medical services	-Allow plenty of time for setting up clear agreements among jurisdictions
c) Electronic Toll Collection	-Cooperation between toll agency and financial institution	-Dedicated short range communications	-Run pilot test on electronic toll collection	-Anticipate new DSRC standards and plan for migration and interoperability
<b>ATIS</b>				
d) Parking Management	-Cooperation between parking operation and financial institution -Cooperation between parking operations and traffic management center	-Dedicated short range communications -Changeable message signs	-Install changeable message signs to advise parking availability at key urban locations -Install electronic payment systems at parking facilities	-Anticipate new DSRC standards and plan for migration and interoperability -Anticipate new electronic payments with smart cards
e) Pre-trip Travel Information	-Cooperation between traffic management center and media	-Electronic data exchange	-Install media booths at traffic management center -Establish telephone call-in services with human operators	-Beware of rapidly increasing demand for call-in services and high cost of human operators
f) Route Guidance	-Cross-jurisdictional cooperation	-Digital map database -Route optimization software	-Establish static route guidance service at car rental offices	-Beware of high cost and time required for digital map updating
<b>APTS</b>				
g) HOV Lanes	-Cooperation between public transport operation and road authority	-Vehicle recognition system -Automated road block	-Install vehicle-roadside communication system -Install automated road block system	-Difficulty in checking number of people in vehicles
h) Traveler Information / Kiosk	-Cooperation between all the public transport operations -Eventually with traffic management center -Eventually with land owner (shopping mall, etc.)	-Automated vehicle location -Electronic data exchange	-Install automated vehicle location -Establish information kiosks (e.g., at railway or bus stations)	-Kiosk design must be user-friendly -The general public prefers interaction with people rather than machines



**-About the Authors**

**Dr. Kan Chen** is Professor Emeritus of Electrical Engineering and Computer Science at the University of Michigan. During his 25 years at the university he co-founded the ITS program, which includes both research and education components. After retirement from teaching Dr. Chen continued as a consultant to the Joint Program Office for ITS at the US Department Transportation. He received his advanced degrees from MIT. and is a Fellow of IEEE and AAAS.

**Dr. Christine Johnson** has been Director of the Joint Program Office for ITS at the U.S. Department of Transportation since July, 1994. From 1990 until 1993, she served as Assistant Commissioner of Policy and Planning for the New Jersey Department of Transportation. From 1984 to 1990 she held various positions at the Port Authority of New York and New Jersey. She holds degrees in English Literature, Urban Transportation Planning and Public Policy Analysis from the University of Illinois Chicago.

